

METHOD FOR USING PARTITIONING TO PROVIDE CAPACITY ON DEMAND IN DATA LIBRARIES

Attorney Docket No. 30014517-1

Serial No. 10/033,003

1. A method for providing data storage capacity on demand comprising:
disabling a set of slot elements and data transfer elements of a data library disallowing access to said disabled set by end users of said library;
partitioning at least a portion of a set of active data media storage slot elements and active data transfer elements of said data library, exclusive of said disabled set, into partitions for use by said end users; and
redefining said sets in response to changes in storage capacity rights of said end users.

13. A method for providing data storage capacity on demand comprising :
reserving a set of data media storage slot elements and data transfer elements in a data library for present and future use by a customer;
disabling a subset of said set of slot elements and data transfer elements;
partitioning said reserved set into a subset of said set of slot elements and data transfer elements activated as a partition secured for use by said customer, wherein said subsets are exclusive of one another; and
redefining said partition by moving at least one element between said subsets in response to changes in storage capacity needs of said customer.

17. A method for limiting access to data storage capacity in a data library, said method comprising :
disabling a set of slot elements and data transfer elements of said data library, disallowing access to said disabled set;
partitioning at least a portion of a set of active slot elements and active data transfer elements of said data library into partitions for use by one customer, wherein said sets are exclusive of one another; and
keying numbers of said elements in said partitioned set on a license purchased by said customer.

SYSTEM AND METHOD FOR SECURING FIBER CHANNEL DRIVE ACCESS IN A PARTITIONED DATA LIBRARY

Attorney Docket No. 30014516-1

Serial No. 10/033,010

1. A storage area network associated data library partitioning system comprising:
a plurality of storage slot elements adapted to store data storage media, at least one set of
at least one of said slots is assigned to one partition of a plurality of partitions;

a plurality of data transfer elements that are adapted to receive said media and transfer
data to and from said media, each of at least one set of at least one of said data transfer elements
is assigned to one of said partitions, at least one data transfer element of each of said partitions
hosts a logical element designation of a virtual controller for each of said partitions, said virtual
controllers restricting movement of said media to between said set of slots and said set of data
transfer elements assigned to a same of said partitions

12. A method for partitioning a storage area network associated data library
comprising:

establishing a plurality of partitions in said data library, each of said partitions comprising
at least one storage slot element and at least one data transfer element, each of said slots adapted
to store media, and each of said data transfer elements adapted to receive said media and transfer
data to and from said media;

assigning a different logical element designation to each of said library partitions and
assigning a same logical element designation as a partition to a virtual controller hosted by at
least one of said data transfer elements in said partition; and

restricting movement of said media to between said slots and said data transfer elements
assigned to a same partition.

18. A partitioned storage area network with an associated data library, said network comprising:

- a data storage array that is divided into partitions, each of said partitions assigned a logical unit number;

- data-mover interconnectivity that extends between said data storage array and said associated data library, via at least one bridge;

- a library management interface that accepts user input partitioning said library and assigns a logical unit number corresponding to logical unit numbers of said array partitions to library partitions, each of said library partitions comprising:

 - a set of at least one storage element slot, each slot comprised of a plurality of storage element slots, said slots are adapted to store data storage media; and

 - a set of at least one data transfer element, said data transfer elements are adapted to receive said media and transfer data to and from said media, at least one data transfer element in each of said partitions comprising a virtual controller that restricts movement of said media to between said set of slots and said set of data transfer elements assigned to a same partition; and

 - at least one data mover for direct communication from said array to said library.

SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO DATA STORAGE MEDIA BASED ON MEDIUM IDENTIFIERS

Attorney Docket No. 30014515-1

Serial No. 10/034,888

1. A method for securing access to a data medium comprising:
listing at least one unique identifier of media that a data transfer element is allowed to access in memory storage of said data transfer element;
accessing only media having at least one of said listed unique identifiers in media cartridge memory with said data transfer element; and
writing a unique identifier associated with said data transfer element to said cartridge memory of said selected medium with said data transfer element in response to no library assigned unique identifier being present in said cartridge memory of said selected medium.
9. A method for securing access to data media in a particular partition of a partitioned data library, said method comprising:
listing at least one unique identifier of media that data transfer elements in said partition are allowed to access in memory storage of said data transfer elements in said partition;
reading a unique identifier from cartridge memory of a selected medium with a data transfer element receiving said selected medium;
checking said memory storage of said data transfer element receiving said selected medium for said unique identifier of said selected medium; and
accessing said selected medium in response to said unique identifier of said selected medium being present in said memory storage of said data transfer element receiving said selected medium.
16. A partitioned data library comprising:
data storage media, each medium of said media having cartridge memory;
a plurality of storage element slots, each of said slots adapted to store one medium of said data storage media, at least one set of at least one of said slots assigned to one partition of a plurality of library partitions; and

a plurality of data transfer elements that are adapted to receive said media, read said medium cartridge memory and transfer data to and from said media, each of at least one set of at least one of said data transfer elements assigned to one of said library partitions, wherein said cartridge memory of a selected medium is read by one of said data transfer elements receiving said selected medium and access to said media by said data transfer elements is restricted to selected media having at least one particular unique identifier stored in said medium cartridge memory.

SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO MEDIA BASED ON MEDIUM IDENTIFICATION NUMBERS

Attorney Docket No. 30014514-1

Serial No. 10/034,518

1. A method for securing access to a data medium said method comprising:
recording a unique identification number assigned to each medium in at least a portion of
a data library; and

commanding at least one selected data transfer element in said library to only accept
media having particular ones of said identification numbers.

14. A method for securing access to data media in a particular partition of a
partitioned data library, said method comprising:

listing identification numbers of media that data transfer elements in said partition are
allowed to access in memory storage of said data transfer elements in said partition;

reading an identification number of a selected medium;

checking said memory storage of a data transfer element receiving said selected medium
for said identification number of said selected medium; and

accessing said selected medium in response to said identification number of said selected
medium being present in said memory storage of said data transfer element receiving said
selected medium.

22. A partitioned data library comprising:
data storage media, each medium of said media having an identification number;
a plurality of storage element slots each of said slots adapted to store a medium of said
data storage media, at least one set of at least one of said slots assigned to one partition of a
plurality of library partitions; and

a plurality of data transfer elements that are adapted to receive said media and transfer
data to and from said media, each of at least one set of at least one of said data transfer elements
assigned to one of said library partitions, wherein access to said media by each of said data
transfer elements is restricted to media having particular ones of said identification numbers.

SYSTEM AND METHOD FOR PERIPHERAL DEVICE VIRTUAL FUNCTIONALITY OVERLAY

Attorney Docket No. 30014513-1

Serial No. 10/032,923

1. A method for providing a peripheral device virtual functionality overlay for a data library, said method comprising:

intercepting commands to a library data transfer element within a bridge disposed between a command initiator and said library;

passing through commands that can be carried out by said data transfer element to said data transfer element; and

executing, with said bridge, commands addressed to said data transfer element that cannot be carried out by said data transfer element.

12. A peripheral device virtual functionality overlay system for a partitioned data library, said overlay system comprising:

a lookup table that indicates unique host device identifiers authorized to access each of said data transfer elements of said library; and

a bridge disposed between a storage area network and said partitioned data library, wherein said bridge comprises firmware that uses said lookup table to determine whether a host initiating commands directed to a data transfer element of said library is authorized to issue commands to said data transfer element, wherein said bridge firmware passes through to said data transfer element authorized commands that can be carried out by said data transfer element and wherein said bridge firmware intercepts and executes commands directed to said data transfer element that cannot be carried out by said data transfer element.

18. A partitioned storage area network with an attached data library, said network comprising:

- a data storage array divided into partitions;

- said library comprising:

 - a plurality of library partitions corresponding to said array partitions;

 - a plurality of data transfer elements each of said data transfer elements assigned to one of said library partitions;

 - a plurality of data storage element slots, each of said slots assigned to one of said library partitions; and

 - a library controller that defines a virtual controller for each of said library partitions, said virtual controllers directing movement of data storage media to and from slots assigned to a same of said partitions and to and from data transfer elements assigned to a same of said partitions, said slots and said data transfer elements assigned to a same of said partitions; and

- at least one bridge disposed between said array and said library, wherein said bridge passes through authorized commands that can be carried out by one of said data transfer elements to said one data transfer element and wherein said bridge intercepts commands directed to said one data transfer element that cannot be carried out by said one data transfer element and executes said commands that cannot be carried out by said one data transfer element.

SYSTEM AND METHOD FOR MANAGING ACCESS TO MULTIPLE DEVICES IN A PARTITIONED DATA LIBRARY

Attorney Docket No. 30014512-1

Serial No. 10/032,662

1. A data library system with managed device access, said system comprising:
 - at least one partition;
 - a plurality of data transfer elements each of said data transfer elements assigned to a partition;
 - a plurality of data storage element slots, each of said slots assigned to a partition;
 - a library controller comprising a virtual controller for each partition, said virtual controller directing movement of said media to and from said slots assigned to a same partition and to and from said data transfer elements assigned to said same partition; and
 - at least one bridge operatively disposed between at least one user and said library, each of said bridges presenting said data transfer elements and said virtual controllers of each partition to said users as logical components beginning at a same designation for each partition.

8. A data library bridge adapted to be operatively disposed between at least one user and said data library, said bridge comprising:
 - means for presenting data transfer elements of said data library attached to said bridge as logical units; and
 - means for presenting a controller for each partition of said data library as a logical unit, said controller directing movement of media to and from storage element slots of said library assigned to a library partition to and from said data transfer elements assigned to a same partition;
 - wherein designations for said logical units in each partition begin at a same number for each partition.

12. A method for partitioning and managing a data library adapted to be attached to a storage area network, said method comprising:

establishing a plurality of partitions in said data library, each of said partitions comprising at least one storage element slot and at least one data transfer element;

controlling movement of media to and from said slots to and from said data transfer elements assigned to a same partition; and

presenting virtual controllers and said data transfer elements for each of said partitions to users of said library as logical components beginning at a same designation for each of said partitions.

28. A partitioned storage area network with a managed attached data library, said network comprising:

a data storage array divided into partitions;

at least one bridge disposed between said array and said library; and

said library comprising:

a plurality of library partitions corresponding to said array partitions;

a plurality of data transfer elements each of said data transfer elements assigned to one of said library partitions;

a plurality of data storage element slots, each of said slots assigned to one of said library partitions; and

a library controller that defines a virtual controller for each of said library partitions, each of said virtual controllers directing movement of said media to and from said slots assigned to a same partition and to and from said data transfer elements assigned to said same partition;

wherein said at least one bridge presents said data transfer elements and said virtual controllers of each of said partitions to users of said network as logical unit numbers beginning at a same logical unit number within each partition.

**SYSTEM AND METHOD FOR PARTITIONING A STORAGE AREA NETWORK
ASSOCIATED DATA LIBRARY EMPLOYING ELEMENT ADDRESSES**

Attorney Docket No. 30014511-1

Serial No. 10/033,009

1. A data library adapted to be attached to a storage area network, said library comprising:

a plurality of partitions;

at least one data transfer element each of said at least one data transfer elements assigned to one of said partitions and assigned an internally unique element address;

a plurality of data storage element slots, each of said slots assigned to a partition and assigned an internally unique element address;

at least one media transport element shared by said partitions to move media between said slots and said at least one data transfer elements, said transport assigned an internally unique element address; and

a library controller that assigns a different logical unit designation to each of said partitions and that assigns external element addresses to said at least one transport, said at least one data transfer element, and said slots for each of said partitions and maps said internally unique addresses to said external addresses, said controller restricting movement of media to and from said slots assigned to a same of said partitions.

10. A method for partitioning a data library adapted to be attached to a storage area network, said method comprising:

assigning a different logical unit designation to each of a plurality of library partitions;
numbering at least one media transport, a plurality of data transfer elements and a plurality of storage element slots with a set of unique internal element numbers, each said slots adapted to store media, each of said data transfer elements adapted to receive said media and transfer data to and from said media and said at least one transport adapted to move media between said slots and said data transfer elements;

establishing said partitions in said data library, each of said partitions comprising at least one of said slots, at least one of said data transfer elements and at least one of said at least one transports;

renumbering said transport, slots and data transfer elements in each of said partitions with externally presented element numbers starting from a same externally presented element number for each partition;

mapping said externally presented element numbers for each of said partitions to said internal element numbers; and

controlling movement of said media to and from said slots assigned to a same partition.

18. A partitioned storage area network with an attached data library, said network comprising:

a data storage array that is divided into a plurality of partitions; and

a library management interface that accepts user input partitioning said library and assigns a logical unit number to library partitions, said library comprising:

a plurality of data transfer elements, each of said data transfer elements assigned to one of said partitions and assigned an internally unique element address;

a plurality of data storage element slots, each of said slots assigned to one of said partitions and assigned an internally unique element address;

at least one media transport element, said at least one media transport element shared by said partitions to move media between said slots and said data transfer elements, said transport assigned an internally unique element address; and

a library controller that assigns external element addresses to said transport, data transfer elements, and slots for each of said partitions and maps said internal addresses to said external addresses for each of said partitions, said controller restricting movement of media between said slots, data transfer elements assigned to a same one of said partitions.

**SYSTEM AND METHOD FOR PARTITIONING A STORAGE AREA NETWORK
ASSOCIATED DATA LIBRARY**

Attorney Docket No. 30014510-1

Serial No. 10/034,691

1. A system for managing a moveable media library, said system comprising:
at least one robotic mechanics; and
a controller, said controller comprising a processor for executing instructions and non-volatile memory for storing at least:
 - code for controlling said at least one robotic mechanics; and
 - code for responding to commands received from host systems to retrieve a moveable medium of a plurality of moveable media, said code for responding is operable to receive said commands addressed with multiple device identifiers according to a device access protocol, and said code for responding is operable to associate each device identifier of said multiple device identifiers with at least one respective library partition.
10. A method for managing a moveable media library, said method comprising:
assigning resources of said moveable media library to partitions of a plurality of partitions;
assigning at least one partition of said plurality of partitions to each communication medium identifier of a plurality of communication medium identifiers;
receiving a device access command, at a robotics controller, from a host system addressed with one of said plurality of communication identifiers; and
determining a partition of said plurality of partitions utilizing said one of said plurality of communication medium identifiers.

17. A system for managing a tape library, said system comprising:
a robotics subsystem operable to retrieve tape cartridges and to place tape cartridges into tape elements;
a robotics controller said robotics controller comprising:
a processor for executing code;
code for receiving a command to access a resource of said tape library, wherein said command is addressed with a communication medium identifier;
code for determining a partition of a plurality of partitions utilizing said communication medium identifier; and
code for controlling said robotics subsystem utilizing at least said determined partition.
23. A controller for managing a moveable media library, said controller comprising:
a processor for executing instructions; and
non-volatile memory for storing at least:
code for controlling at least one robotic mechanics of a moveable media library;
and
code for responding to commands received from host systems to retrieve a moveable medium of a plurality of moveable media of said moveable media library, said code for responding is operable to receive said commands addressed with multiple device identifiers according to a device access protocol, and said code for responding is operable to associate each device identifier of said multiple device identifiers with at least one respective library partition.

SYSTEM AND METHOD FOR MANAGING A MOVEABLE MEDIA LIBRARY WITH LIBRARY PARTITIONS

Attorney Docket No. 30008195-1

Serial No. 10/034,083

1. A storage area network associated data library partitioning system comprising:
a plurality of storage element slots adapted to store data storage media, at least one set of
at least one of said slots is assigned to one partition of a plurality of partitions;
a plurality of data transfer elements that are adapted to receive said media and transfer
data to and from said media, each of at least one set of at least one of said data transfer elements
is assigned to one of said partitions; and
a library controller that assigns a different logical element designation to a virtual
controller for each of said partitions, said virtual controllers directing movement of said media to
and from one of said set of slots assigned to a same of said partitions.

23. A method for partitioning a storage area network associated data library
comprising the steps of:
assigning a different logical element designation to each of a plurality of library
partitions;
establishing said partitions in said data library, each of said partitions comprising at least
one storage element slot and at least one data transfer element, each of said slots adapted to store
media, and each of said data transfer elements adapted to receive said media and transfer data to
and from said media; and
controlling movement of said media to and from said slots assigned to a same partition.

40. A partitioned storage area network with an associated data library, said network comprising:

- a data storage array that is divided into partitions, each of said partitions assigned a logical unit number;

- data-mover interconnectivity that extends between said data storage array and said associated data library, via at least one bridge;

- a library management interface that accepts user input partitioning said library and assigns a logical unit number corresponding to logical unit numbers of said array partitions to library partitions, each of said library partitions are comprised of:

 - a set of at least one storage element slot, each slot comprised of a plurality of storage element slots, said slots are adapted to store data storage media; and

 - a set of at least one data transfer element, said data transfer elements are adapted to receive said media and transfer data to and from said media;

 - a library controller that directs movement of said media to and from said set of slots assigned to a same partition; and

at least one data mover for direct communication from said array to said library.